A Debriefing Session with a Nutritionist Can Improve Dietary Assessment Using Food Diaries[1]

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ABSTRACT The objective of the current study was to evaluate the effect of a debriefing call on nutrient intake estimates using two 3-d food diaries among women participating in the Women's Health and Interview Study (WISH) Diet Validation Study. Subjects were 207 women with complete data and six 24-h recalls (24-HR) by telephone over 8 mo followed by two 3-d food diaries during the next 4 mo. Nutrient intake was assessed using the food diaries before and after a debriefing session by telephone. The purpose of the debriefing call was to obtain more detailed information on the types and amounts of fat in the diet. However, due to the ubiquitous nature of fat in the diet, the debriefing involved providing more specific detail on many aspects of the diet. There was a significant difference in macronutrient and micronutrient intake estimates after the debriefing. Estimates of protein, carbohydrate, and fiber intake were significantly higher and total fat, monounsaturated fat, saturated fat, vitamin A, vitamin C, α-tocopherol, folic acid, and calcium intake were significantly lower after the debriefing ($P < 0.05$). The limits of agreement between the food diaries before and after the debriefing were especially large for total fat intake, which could be under- or overestimated by $\sim$15 g/d. The debriefing call improved attenuation coefficients associated with measurement error for vitamin C, folic acid, iron, α tocopherol, vitamin A, and calcium estimates. A hypothetical relative risk (RR) = 2.0 could be attenuated to 1.16 for folic acid intake assessed without a debriefing but to only 1.61 with a debriefing. Depending on the nutrients of interest, the inclusion of a debriefing can reduce the potential attenuation of RR in studies evaluating diet disease associations. J. Nutr. 136: 440–445, 2006.

KEY WORDS: • *food diaries* • *dietary assessment* • *attenuation*

Epidemiologic studies that have examined dietary intake and disease outcome have been hampered by the substantial measurement error associated with the use of FFQ (1,2). Recent biomarker studies have cast doubt on whether the FFQ has sufficient precision to allow detection of moderate but important diet-disease associations (1–4). In the Observing Protein and Energy Nutrition (OPEN)[3] study (1), using an FFQ, 24-h recalls (24-HR), doubly labeled water, and urinary nitrogen, the authors calculated attenuation factors for absolute energy, absolute protein, and protein density. They concluded that because of severe attenuation, the FFQ could not be recommended as an instrument for evaluating relations between absolute intake of energy or protein and disease (1).

Alternatives to the FFQ must therefore be considered and these include food diaries, 24-HR, and diet history methods. Biró et al. (5) outlined the criteria that should be used to select a dietary assessment method as follows: the food or nutrient of primary interest; the need for group vs. individual data; the need for absolute vs. relative intake estimations; characteristics of the population; the time frame of interest; the level of specificity needed for describing foods; and available resources. The quality of any dietary assessment method depends on 2 types of error, i.e., measurement error or bias, and random error (6). Measurement error depends on the accuracy of the reported intake by the participant, and can be improved by limiting the amount of missing or undefined data. Volatier et al. (6), described

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[3] Abbreviations used: 24-HR: 24 hour recalls; NCC: Nutrition Coordinating Center; NDS, Nutrition Data System; OPEN, Observing Protein and Energy Nutrition; WISH: Women's Health and Interview Survey.

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how measurement error is related to the description of foods, to procedures used to code and aggregate single food items, and to the statistical analysis. In addition, suitable data checks must be incorporated to link food intake to nutrient composition data (7).

Day et al. (3) suggested the use of a 7-d food diary as a superior dietary assessment method for individual nutrient intake compared with an FFQ based on results of a study in 179 participants who completed 2 FFQ, two 7-d food diaries, and six 24-h urine collections analyzed for potassium, nitrogen, and sodium. The diary was more closely correlated with the biomarker measurements for all 3 nutrients than the FFQ. Further, these investigators showed that dietary fat was related to breast cancer risk using the food diary but not with the FFQ (8), suggesting that perhaps diaries should be incorporated into large studies. Food diaries with weighed portion size are considered one of the best instruments among dietary assessment methods. Nonetheless, food diaries have also raised concerns including the possibility that habitual eating patterns may be influenced or changed by the recording process. Biró et al. (5) outlined the main concerns associated with food diaries. For example, participants may forget to record items immediately after eating, increasing the likelihood of omitting foods when they later record their intake. They may also be imprecise in measuring the amounts of foods eaten, thereby increasing error. Finally, the reliability of food diaries decreases over time due to respondent fatigue because they are associated with a high degree of participation burden.

As with all dietary assessment methods, there are also several advantages to food diaries: a greater amount of detail can be recorded because the food diaries are open ended; the diary method does not rely on the respondents' memory; therefore some errors may be minimized. Portion size can be weighed or estimated using household utensils and food models.

The objectives of the current study were 2-fold: first, to assess whether estimates of macro- and micronutrient intake using two 3-d food diaries are affected by including a debriefing call to the participants from a nutritionist. Second, to estimate the attenuation coefficients for nutrient intake assessed before and after the debriefing call was administered and by extension, the potential attenuation of a hypothetical relative risk (RR) for a nutrient-disease outcome. Dietary intake assessed using six 24-HR was used as the reference method for comparison with the food diaries, in the absence of a true gold standard.

SUBJECTS AND METHODS

The Women's Health and Interview Study (WISH) Diet Validation Study is an adjunct to WISH, a case-control study of breast cancer conducted between May 1, 1990 and December 31, 1992. The details and methodology of this case-control study and the WISH validation study were described previously (9,10). In brief, the WISH study was conducted in 3 areas in the United States: Atlanta, GA; Seattle/Puget Sound, WA; and 5 counties in central New Jersey. Controls were frequency-matched by region and age to the expected distribution of cases and were identified through Mitofsky-Waksberg random-digit dialing techniques (11). The overall response rate achieved for controls in this case-control study was 78.1% (2009 of 2571 eligible controls). Participants were 20–44 y old; in Atlanta, the age range was extended through 54 y of age. After giving written informed consent, participants were interviewed in person about demographic factors, reproductive and menstrual history, smoking, occupation, lifestyle factors, anthropometry, and physical activity. In addition, participants were asked to complete a 100-item FFQ. Women participating in the WISH validation study who were subsequently found to be eligible to be included in this analysis were identified from among the controls who participated in the original WISH case-control study. Methods for the validation study are provided in detail elsewhere (10). In brief, the sampling frame included controls for whom a FFQ had been completed within the previous year. Women were considered ineligible if they had developed a stomach ulcer, diabetes, heart disease, cancer, or another serious illness that might have a major effect on their diet since the time of their WISH interview. In addition, those who had lost or gained >4.54 kg since the WISH interview or who were pregnant in the past year were also excluded.

Dietary assessment. Of the 362 women eligible and recruited to participate in the WISH Diet Validation study, 283 were asked to complete 2 sets of 3-d food diaries (6 d of dietary assessment) and six 24-HR by telephone over a 1-y period. Some or all of the diaries were completed by 248 women and 225 filled out diaries for all 6 d; 18 women were later excluded because the debriefing calls were completed unsuccessfully. This analysis included the remaining 207 women who completed six 24-HR by telephone over 8 mo followed by two 3-d food diaries during the next 4 mo and 2 debriefing calls.

24-Hour recall (24-HR). The Nutrition Data System (NDS), an automated software system developed by the Nutrition Coordinating Center (NCC) at the University of Minnesota (12), was used to administer the 24-HR via telephone by trained interviewers. Interviewers initially compiled a list of all foods and beverages consumed by the participant during the specified 24-h period. Next, the interviewer probed for specific details of each food reported on the list. The NDS screens help interviewers prompt respondents for additions to foods and beverages, recipe ingredients, portion sizes, and food preparation methods. The use of food models to assess portion size was encouraged by the interviewer. Probing was essential for obtaining detailed information on consumption of fats and foods high in fat, the use of fats in preparing food and added at the table, and specification of the type of fats consumed. All six 24-HR were completed before the food diary component of the study was initiated.

Food diaries. Each woman received a phone call to ensure that she had received a food diary by mail and to provide her with brief instructions on completing the diary. A package of food models which included measuring spoons and cups, a ruler, bowls, drinking glasses, and a ring with various sizes of circles, triangles, rectangles and squares, was mailed to each participant after she was recruited into the validation study to help estimate portion sizes. The participants were encouraged to use the food models at all times to aid in estimating portion sizes, such as using the triangle shapes (wedge) to describe slices of pizza, cake, and fish fillets; circle shapes for fruits, cookies, pancakes, muffins; and square shapes for lasagna, dessert bars, or cheese, for example. The diary was designed to allow participants to keep a list of foods and beverages consumed over the course of 3 consecutive days, and specific dates for recording were printed on the front of the diary to avoid recording during holidays. The first 3-d diary was completed in the month after the final 24-HR, and the second 3-d diary was completed ~3 mo later. Several types of reminders were sent to encourage completion and return of the diaries. For example, the dates on which the diary was to be completed were printed on the label on the front of the diary booklet. An instruction phone call was provided 1–6 d before the first intake day of the diary. A reminder postcard to prompt the subject to mail back the diary was sent out on approximately the first intake day. If the completed diary was not returned within 14 d of the first intake day a "no receipt call" was made to remind the women to return the diaries.

Seven trained coders entered food diaries into the Nutrition Data System (NDS) using a set of rules to standardize the entry of foods with incomplete data. For example, computer prompts elicit responses that enhance completeness and specificity of items in the diary, and out of range quantities are flagged for prompt quality control. The NDS Food Database contains >16,000 food items (and >150,000 variants differing in preparation method), dietary supplements, medications, medications containing caffeine and sodium, and >6000 brand name foods. Foods reported by the respondents that were not found in the NDS Food Database were referred to the NCC for resolution. The NCC provided a key-list of food codes present in the database that would define the missing food and yield its proper nutrient content. The nutrient database also included revised USDA entries (13) and USDA consumption data. These included an expanded number of fish entries according to differences in total fat; a new default for unknown type of milk to 2% fat from whole; revised entries for 9 brand name cereals based on manufacturers' reformulations; and additional generic entries for commercial cookies based on fat, sodium, and cholesterol content. When details were not specified in a diary, the coder chose the "unknown" screen and default values used by the NCC or USDA coding guidelines were automatically entered. For example if a screen requested information on the choice of "Brewed" or "Instant" coffee; choosing "unknown" would default to the most common code used by the NCC for coffee. Default amounts were obtained from the USDA survey database, or a market check was completed. However when details were not specified for foods that varied in fat content, the coder made a note of it and chose the default for portion size or nutrient content. Additional information on portion size and fat content of these foods was collected during the debriefing call (e.g., the percentage fat content of milk used). Because NDS provided immediate nutrient calculations, printouts of nutrient intake were reviewed and exceptionally high or low intakes were verified. An electronic copy of each of the 3-d food diaries was made before a debriefing call was made and will be referred to as the *undebriefed diaries*.

Food diaries and the debriefing call. After the diary was coded, a reviewer compared the hard copy record reports generated by the NDS with the 3-d food diary. The reviewer was responsible for correcting coding errors in the NDS, completing missing food forms on all uncodeable foods, and preparing the hard copy report for the debriefing call. This included recording specific probes on the hard copy for the interviewer to ask the participant. A debriefing call was conducted within 8 wk of the first intake day, although some exceptions were made to extend the time period beyond this limit. The purpose of the debriefing call was to obtain more detailed information regarding fat intake, including the brand name information, type of fat, and the fat content of foods. Typical fat-related questions in a debriefing call included probing for the fat content such as the percentage of fat, regular, reduced fat, or nonfat for foods such as cheese, yogurt, cakes, or crackers; type of oil (e.g., vegetable, corn, or soybean); form of margarine used (stick, tub, or squeeze); and brand name information. Recipes were also clarified when ingredient amounts did not match the total yield reported by the respondent, when the serving size was not comparable to the recipe yield, or when there were probable missing ingredients (e.g., stir fry for which no cooking fat was reported). Additionally, the reviewer included probes to verify unusual amounts reported by the participant or to obtain more complete descriptions of uncodeable foods. Diaries are referred to as *debriefed diaries* after the debriefing call was made and changes were incorporated into the food diary.

Statistical analysis. All statistical analyses were carried out in SAS® (version 8.2). Spearman rank correlation coefficients were calculated for all macro- and micronutrients calculated from the food diaries assessed before and after the debriefing call was administered. The Bland-Altman procedure (14) was implemented as follows: the mean difference in nutrient intake was calculated (undebriefed − debriefed) and 95% limits of agreement for individuals were calculated as the mean difference ± 2 SD. A *t* test was carried out to test for significant differences in nutrient intake assessed before and after the debriefing. The level of significance was set at $\alpha = 0.05$ and the *P*-values quoted are two-sided. Nutrient intakes were categorized into quintiles of intake and cross-classification of participants by the undebriefed and debriefed food diaries was calculated. Attenuation coefficients (λ) were calculated by regressing the mean nutrient intake assessed by six 24-HR (used as the reference method) on the mean nutrient intake assessed by the 6-d food diaries before and after the debriefing call. Sensitivity analysis was carried out to test for differences in energy and fat intake before and after the debriefing call by quartiles of BMI (≤21.9, 21.91–24.8, 24.81–29.3, >29.3 kg/m^2), quartiles of age (≤38, 39–42, 43–47, and >47 y), and for those who were debriefed within 30 d of completing the food records compared with those who were debriefed after 30 d.

RESULTS

The nonparticipants (i.e., those who participated in the adjunct validation study but not the present study) were similar to the participants in age, parity, BMI, education, smoking, alcohol use, and oral contraceptive use (**Table 1**). A greater percentage of nonparticipants were African-American or of other race/ethnicities ($P = <0.01$) compared with participants.

Group estimates of total protein (g and % energy), total carbohydrate (% energy), all fiber types, and vegetable protein intake were higher after the debriefing call ($P < 0.05$),(**Table 2**). Group estimates of total fat (% energy), saturated fat (g and % energy), monounsaturated fat (% energy), vitamin A, vitamin C, α-tocopherol, folic acid, calcium, and iron intake were all lower after the debriefing call ($P < 0.05$) (Table 2). In addition, as seen from the limits of agreement, there was considerable variability in dietary estimates for individual intake. For example, an individual's protein intake could be overestimated by ~16 g/d and underestimated by ~13 g/d. In addition, vitamin C intake estimates for an individual could be under- or overestimated by >400 mg/d. The percentage agreement (i.e., the percentage of individuals classified into the exact same quintile of intake before and after the debriefing call), ranged from 48.3% for α-tocopherol to 84.5% for insoluble fiber (Table 2).

Dietary intake estimates calculated before and after the debriefing session were cross-classified to show concordance and discordance for the same women (**Table 3**). Folic acid intake was in low agreement because 116 (56.0%) were perfectly classified, whereas insoluble fiber had a high agreement because 175 (84.5%) women were perfectly classified before and after debriefing. Debriefing increased the category of intake of folic acid for the lowest 4 quintiles, whereas undebriefed insoluble fiber estimates were just as likely to be increased or decreased across quintiles of intake by a debriefing session. The percentage who remained within 1 quintile of intake was 91.3% ($n = 189$) for folic acid and 100% ($n = 207$) for fiber intake.

TABLE 1

Characteristics of the participants and nonparticipants in the WISH Diet Validation Study[1]

	Participants	Nonparticipants	*P*-value[2]
n	207	76	
Age, *y*	42.20 ± 6.19	41.45 ± 5.38	0.358
Births, *n*	1.79 ± 1.22	1.92 ± 1.29	0.44
BMI, *kg/m²*	26.42 ± 6.25	25.43 ± 5.43	0.22
Race/ethnicity, *n* (%)			
White	161 (77.78)	44 (57.89)	
Black	42 (20.29)	30 (39.50)	<0.01
Other	4 (1.93)	2 (2.63)	
Education, *n* (%)			
≤High School graduate	51 (24.64)	16 (21.05)	
Vocational/Technical	18 (8.70)	6 (7.89)	
Some college	56 (27.05)	17 (22.37)	0.65
College graduate	52 (25.12)	26 (34.20)	
Postgraduate	30 (14.49)	11 (14.47)	
Smoking, *n* (%)			
Yes	98 (47.34)	39 (51.32)	
No	109 (52.66)	37 (48.68)	0.55
Alcohol use, *n* (%)			
Nondrinker	34 (16.43)	10 (13.16)	
Nonregular drinker	56 (27.05)	16 (21.05)	0.372
Regular drinker	117 (56.52)	50 (65.79)	
Oral contraceptive use, *n* (%)			
Nonuser	49 (23.67)	18 (23.68)	
User[3]	158 (76.33)	58 (76.32)	0.99

1 Values are means ± SD or *n* (%).
2 Unpaired *t* test for continuous variables, χ^2 test for categorical data.
3 Used oral contraceptives for >6 mo.

TABLE 2

Agreement in nutrient intake of 207 healthy women assessed by 6-d food diaries before (undebriefed) and after debriefing (debriefed)

	Undebriefed[1]	Debriefed[1]	*P*-value[2]	Limits of Agreement[3]	% (*n*) Agreement[4]
Energy, *kJ*	6825.0 ± 1966.4	7022.4 ± 2030.7	0.83	−1154.6, 1136.9	74.9 (155)
Total protein, *g/d*	64.0 ± 17.5	65.1 ± 17.6	0.02	−15.5, 13.2	61.4 (127)
Total protein, *% energy*	16.3 ± 3.3	16.6 ± 3.3	<0.01	−11.0, 10.4	72.0 (149)
Total carbohydrate, *g/d*	200.0 ± 63.2	202.0 ± 65.1	0.07	−34.3, 30.3	79.7 (165)
Total carbohydrate, *% energy*	49.9 ± 7.1	50.4 ± 7.2	<0.01	−5.2, 4.2	72.0 (149)
Total fat, *g/d*	63.3 ± 23.6	62.2 ± 24.7	0.05	−15.3, 17.5	74.4 (154)
Total fat, *% energy*	34.0 ± 6.2	33.2 ± 6.5	<0.01	−3.6, 5.2	72.5 (150)
Saturated fat, *g/d*	21.9 ± 9.3	21.3 ± 9.6	<0.01	−5.4, 6.5	75.4 (156)
Saturated fat, *% energy*	11.6 ± 2.8	11.3 ± 2.8	<0.01	−1.4, 2.1	73.4 (152)
Monounsaturated fat, *g/d*	24.0 ± 9.2	23.5 ± 9.7	0.04	−6.4, 7.4	72.5 (150)
Monounsaturated fat, *% energy*	12.8 ± 2.7	12.5 ± 2.8	<0.01	−1.7, 2.4	66.7 (138)
Polyunsaturated fat, *% energy*	6.8 ± 1.7	6.8 ± 1.8	0.63	−0.1, 0.1	67.2 (139)
Polyunsaturated fat, *g/d*	12.6 ± 5.1	12.7 ± 5.3	0.98	−3.9, 4.1	67.2 (139)
Animal protein, *g/d*	44.0 ± 14.7	44.7 ± 14.7	0.11	−14.5, 13.0	66.2 (137)
Vegetable protein, *g/d*	19.4 ± 6.3	19.8 ± 6.5	<0.01	−3.4, 2.7	80.7 (167)
Total fiber, *g/d*	13.7 ± 5.3	13.9 ± 5.3	<0.01	−2.0, 1.5	78.7 (163)
Insoluble fiber, *g/d*	8.8 ± 3.7	9.0 ± 3.7	<0.01	−1.4, 1.1	84.5 (175)
Soluble fiber, *g/d*	4.7 ± 1.7	4.8 ± 1.8	<0.01	−0.7, 0.6	79.7 (165)
Vitamin A, *µg retinol equivalent/d*	1193.0 ± 948.7	968.9 ± 657.9	<0.01	−1038.4 1486.1	55.1 (114)
Vitamin C, *mg/d*	155.7 ± 227.4	83.7 ± 48.7	<0.01	−427.9, 499.9	58.9 (122)
α-Tocopherol, *mg/d*	36.5 ± 137.8	7.5 ± 3.1	<0.01	−246.5, 304.5	48.3 (100)
γ-Tocopherol, *mg/d*	13.8 ± 6.4	14.1 ± 6.8	0.14	−5.8, 5.2	67.2 (139)
β-Carotene, *µg/d*	3312.0 ± 3212.0	3233.2 ± 3090.8	0.20	−1698.9, 1857.3	81.2 (168)
Folic acid, *µg/d*	307.3 ± 221.8	232.0 ± 95.6	<0.01	−284.4, 435.0	56.0 (116)
Calcium, *mg/d*	666.4 ± 371.1	617.5 ± 279.6	<0.01	−346.2, 493.0	74.4 (154)
Iron, *mg/d*	16.0 ± 12.7	12.5 ± 4.4	< 0.01	−19.0, 25.9	56.5 (117)

1 Values are means ± SD.
2 Mean difference intake (undebriefed − debriefed) is significantly different from zero.
3 Limits of agreement = $\text{mean}_{\text{difference}} \pm 2\ \text{SD}_{\text{difference}}$.
4 Exact quintile agreement.

Energy and fat intake (g and % energy) before and after the debriefing call did not differ when the results were stratified by age, BMI, race, or by the number of days between completion of the food diaries and the debriefing call (data not shown).

Attenuation coefficients were calculated and the resulting attenuation of a hypothetical RR of 2.0 if food diaries were used alone (undebriefed) or in conjunction with a debriefing call (debriefed) was calculated (**Table 4**). Clearly, the debriefing did not alter the attenuation coefficient for most nutrients, including macronutrient intake, fiber, γ-tocopherol, or β-carotene intake. However, it dramatically improved attenuation of vitamin A, vitamin C, α-tocopherol, folic acid, calcium, and iron intake. For example, a RR = 2.0 could be attenuated to 1.16 for folic acid intake assessed without a debriefing call, and 1.61 with the inclusion of a debriefing call.

TABLE 3

Quintile agreement comparing food diaries of 207 healthy women before and after debriefing, for folic acid and insoluble fiber

		Quintiles of intake: debriefed food diaries				
		Q1	Q2	Q3	Q4	Q5
Quintiles of folic acid: undebriefed food diaries	Q1	34	6	1	0	0
	Q2	3	28	11	0	0
	Q3	1	1	20	19	0
	Q4	3	3	3	13	20
	Q5	0	4	6	10	21
Quintiles of insoluble fiber: undebriefed food diaries	Q1	36	5	0	0	0
	Q2	5	32	5	0	0
	Q3	0	5	33	3	0
	Q4	0	0	3	36	3
	Q5	0	0	0	3	38

DISCUSSION

The aim of this study was to examine how a debriefing call by a trained nutritionist could improve the assessment of both macro- and micronutrient intake. The results clearly demonstrate that the addition of a debriefing call after the completion of two 3-d food diaries can significantly alter nutrient intake estimates. Specifically, estimates of protein, carbohydrate, and fiber intake were significantly higher after the debriefing call, whereas estimates of total fat, saturated fat, monounsaturated fat, vitamin A, vitamin C, α-tocopherol, folic acid, calcium and iron intake were all lower after the debriefing call ($P < 0.05$). The inclusion of a debriefing call also dramatically improved the attenuation coefficients for micronutrients that play an important role in modulating cancer risk. These included vitamin A, vitamin C, α-tocopherol, folic acid, calcium, and iron. A debriefing call after the completion of a set of food diaries could therefore have important implications for diet-disease associations. Food diaries offer an advantage because intake is recorded in real time. It could be argued, therefore, that alterations made as a result of the debriefing call could actually introduce error. However, the debriefing calls were made within 30 d of completing the food diaries for the most part, and

TABLE 4

Attenuation of a relative risk for nutrient intake of 207 healthy women assessed by two 3-d food diaries, before and after a debriefing call

	Undebriefed		Debriefed	
Nutrient	Undebriefed λ[1]	Attenuation of RR = 2.0	Debriefed λ[1]	Attenuation of RR = 2.0
Energy, *kJ/d*	0.61 ± 0.05	1.53	0.59 ± 0.05	1.51
Total protein, *g/d*	0.48 ± 0.06	1.39	0.51 ± 0.06	1.42
Total protein, *% energy*	0.57 ± 0.05	1.48	0.57 ± 0.05	1.48
Total carbohydrate, *g/d*	0.77 ± 0.05	1.71	0.72 ± 0.05	1.65
Total carbohydrate, *% energy*	0.57 ± 0.06	1.48	0.55 ± 0.06	1.46
Total fat, *g/d*	0.46 ± 0.05	1.38	0.44 ± 0.05	1.36
Total fat, *% energy*	0.42 ± 0.05	1.34	0.38 ± 0.05	1.30
Saturated fat, *g/d*	0.43 ± 0.05	1.35	0.41 ± 0.05	1.33
Saturated fat, *% energy*	0.44 ± 0.05	1.36	0.42 ± 0.05	1.34
Polyunsaturated fat, *g/d*	0.48 ± 0.06	1.39	0.44 ± 0.06	1.36
Polyunsaturated fat, *% energy*	0.29 ± 0.06	1.22	0.27 ± 0.06	1.21
Monounsaturated fat, *g/d*	0.45 ± 0.06	1.37	0.44 ± 0.05	1.36
Monounsaturated fat, *% energy*	0.41 ± 0.05	1.33	0.37 ± 0.05	1.29
Total Fiber, *g/d*	0.84 ± 0.05	1.79	0.83 ± 0.05	1.78
Vitamin A, *μg retintol equivalent/d*	0.25 ± 0.04	1.19	0.43 ± 0.05	1.35
Vitamin C, *mg/d*	0.05 ± 0.02	1.04	0.71 ± 0.06	1.64
α-Tocopherol, *mg/d*	0.004 ± 0.002	1.00	0.63 ± 0.06	1.55
γ-Tocopherol, *mg/d*	0.46 ± 0.06	1.38	0.42 ± 0.06	1.34
β-Carotene, *μg/d*	0.47 ± 0.05	1.39	0.50 ± 0.05	1.41
Folic acid, *μg/d*	0.21 ± 0.03	1.16	0.69 ± 0.06	1.61
Calcium, *mg/d*	0.47 ± 0.04	1.39	0.69 ± 0.05	1.61
Iron, *mg/d*	0.18 ± 0.02	1.13	0.65 ± 0.06	1.60

[1] Values are attenuation coefficients ± SE. The attenuation coefficient (λ) was estimated by regressing the mean intake assessed by six 24-HR (reference method) on the mean intake assessed by the 6 food diaries (before and after debriefing).

our analysis indicated that there was no difference in energy or fat intake for those who were debriefed within 30 d of completing the food records compared with those who were debriefed after 30 d.

Inferences regarding diet-disease associations are limited when data are collected only from case-control studies (15). Therefore, large prospective cohort studies are often utilized to assess nutrition-cancer associations in particular. Historically FFQ were used to assess nutrient exposure in large prospective cohorts and were validated by comparison with other dietary assessment methods or biomarkers of intake (16–19). Recent biomarker studies (1–4), however, have cast doubt on whether the FFQ has sufficient precision to allow detection of moderate but important diet-disease associations, particularly for cancer research. Day et al. (3) and Bingham et al. (2) suggested using 7-d food diaries instead of FFQ and showed that estimates of nitrogen, potassium, and sodium intake from the food diaries were more closely associated with urinary biomarkers compared with estimates from an FFQ. It is therefore important that we try to improve upon existing dietary assessment methods for use in future epidemiologic studies. It was hypothesized that the inclusion of a debriefing could improve dietary estimates using food diaries, an alternative to the FFQ. Results of this study clearly demonstrate the benefits of including a debriefing to improve dietary assessment of many micronutrients even though the debriefing was not targeting micronutrient intake. However, the inclusion of a debriefing did not alter the attenuation coefficients for macronutrient intake in the present study. Similarly, Shattuck Kolar et al. (20) showed only modest differences in nutrient intake assessed using 3-d food records before and after the records were reviewed with participants for completeness. However, it is difficult to make a direct comparison between these 2 studies because they differ in several ways. Their food diary was entirely self-administered, whereas participants in the present study received instructions on completing the diary by phone in advance. In addition, debriefing in their study was completed within 1 wk of receiving the completed food records, whereas our study completed debriefing within 8 wk. Nevertheless, the results of the study of Shattuck-Kolar et al. (20) demonstrated that a self-administered food record has potential for use in large cohort studies.

There are several caveats to the present study, however. The women who participated were volunteers and therefore likely to be highly motivated. It is probable, therefore, that they recorded their dietary intake with greater accuracy compared with those who did not participate. In addition, each woman had completed six 24-HR before completing the food diaries. It is possible that they "learned" to record their dietary intake with more accuracy as a result of completing the 24-HR. The generalizability of the results of this study may be limited because the participants were all women and predominantly white. The analysis was stratified by race and the results did not differ for black study participants (20% of total) compared with white participants. It is difficult to know, however, whether a debriefing call can improve nutrient estimates for other racial/ethnic groups and for men.

The inclusion of a debriefing call with food diaries may not be plausible for large-scale prospective cohort studies due to cost considerations. Depending on the number of food diaries used, the cost can be very high because large mailings of diaries and food models are required. In addition, participants must be trained in advance on how to describe their diets and to include information regarding food type, the amount, and the cooking methods used. Participants must be phoned in advance to remind them to begin recording their dietary intake and to return their completed food diaries on completion. Finally, it requires a team of trained people to review the completed diaries and to abstract the necessary information that was missing from the food diaries before the debriefing call. In some settings, the diary could be reviewed in a clinic setting and debriefed at that time. Because it could be ready for coding at a later time, it would be a viable option for a nested case-control study. The corresponding translation of the food diaries into nutrient intake would have to be completed only for the cases and the selected controls, greatly reducing the overall study costs. The added accuracy and precision of this dietary assessment method might justify the use of diaries in large surveys.

The results of the present study clearly demonstrate how the inclusion of a debriefing call can alter dietary intake estimates. The debriefing call dramatically altered the attenuation coefficients for many important micronutrients. A true RR of 2.0 could be attenuated to 1.39 for calcium without a debriefing call compared with an observed RR of 1.61 with a debriefing call. These attenuated RR certainly approach the limits of detection for observational epidemiologic research. If we are interested in detecting a smaller but potentially important RR of 1.5 for nutrient intake and disease, that RR could be reduced to 1.09 for folic acid intake assessed using undebriefed food diaries. However, inclusion of a debriefing would attenuate the RR only to 1.32. Investigators who choose to use food diaries should therefore consider inclusion of a debriefing especially for hypotheses that include micronutrients, which were shown in the present study to be dramatically altered after the debriefing call.

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